

Trends and patterns of maternal complications and their implications for neonatal outcomes in Atiwa East District, Ghana: a three-year retrospective analysis (2021–2023)

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Abstract

Background: Maternal complications remain a major driver of poor maternal and neonatal outcomes in Ghana, yet district-level evidence is limited.

Objective: To analyze trends in maternal complications and outcomes from 2021 to 2023 in Atiwa East District, Eastern Region of Ghana.

Methods: A retrospective review of delivery records was conducted in two major facilities. Data on complications, maternal deaths, and transfusions were extracted for all deliveries between 2021 and 2023. Descriptive statistics and linear trend analysis were performed; maternal mortality ratios (MMR) were calculated per WHO guidelines.

Results: A total of 3,867 deliveries were recorded, with three maternal deaths (MMR: 77.5 per 100,000 live births). The most common complications were pregnancy-induced hypertension (5.9%), preterm labour (3.5%), and postpartum haemorrhage (2.0%). PIH and PPH increased steadily over the three years ($R^2 = 0.75$ and 0.83 , respectively). Overall, 20.2% of women required blood transfusion.

Conclusion: Rising rates of hypertensive and haemorrhagic complications present growing risks for maternal and neonatal survival in Atiwa East District. Strengthened antenatal surveillance, reliable blood bank capacity, and community education are urgently needed to reduce adverse outcomes.

Keywords: maternal complications, postpartum haemorrhage, pregnancy-induced hypertension, cephalo-pelvic disproportion, Atiwa east, Ghana; retrospective study

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Introduction

Maternal morbidity and mortality remain major global public health priorities. Each year, hundreds of thousands of women die from pregnancy-related complications, even though the global maternal mortality rate was said to have declined by approximately 40% reduction since 2000¹ Severe maternal conditions such as hemorrhage, hypertensive disorders, and obstructed labour continue to contribute substantially to this burden, particularly in low-and middle-income countries.^{2,3}

In sub-Saharan Africa, health systems face challenges such as limited facility readiness, inconsistent supply of critical drugs/or blood, referral delays, and shortage of skilled personnel. Structural and process readiness assessments in Ghana and Uganda reveal that many health facilities lack full capability for managing Postpartum

Hemorrhage (PPH), including blood transfusion capacity and standardized protocols.⁴

Ghana has progressed in maternal health indicators according to the 2022 Ghana Demographic and Health Survey [5], which shows improvements in antenatal care attendance and skilled birth attendance, but persistent disparities remain, particularly in rural districts and in readiness for emergency obstetric complications. A recent modeling study estimated that substandard uterotonics contribute substantially to Postpartum Haemorrhage (PPH) burden and economic costs in Ghana, including increased need for blood transfusions per year when uterotonics are of poor quality.⁶

Within the Eastern Region, maternal health outcomes mirror national challenges. Recent cohort data from the region show significant associations between social and physical characteristics

and increased risk of preeclampsia/eclampsia and obstetric hemorrhage which indicates that both individual and facility-level factors contribute to rising maternal complication rates in this region.⁷ Travel time and distance to facilities further influence whether women deliver in health centers or delay care, increasing the risk of severe complications.⁸ Rural mothers continue to face barriers due to geography, infrastructure, and health worker attitudes, which impede access to skilled delivery services.⁹

Atiwa East District, a predominantly rural district in the Eastern Region, faces similar challenges. Poverty and deprivation in the district limit access to timely maternal care, and local data on trends of maternal complications are scarce.¹⁰ This study therefore aims to examine patterns of selected maternal complications in Atiwa East from 2021 to 2023, and provide evidence to support policy and resource allocation at district and regional levels.

Methods

Study design and setting

This was a retrospective descriptive study based on facility and district health records from 1 January 2021 to 31 December 2023. Atiwa East District, located in Ghana's Eastern Region, is predominantly rural. The district has an estimated population of 64,647, with women of reproductive age forming a significant proportion.¹⁰ Healthcare delivery is anchored by Enyiresi Government Hospital, which functions as the main referral facility. Additionally, three government health centres provide primary care to surrounding communities. A network of 23 Community-based Health Planning and Services (CHPS) compounds extends basic healthcare to residents at the community level. Recently, two new CHPS compounds at Akyem Mampong and Ahankrasu were established with delivery units, wards, outpatient departments, staff accommodation, and mini-laboratories, further strengthening access to maternal and child health services.

Data collection

Data were extracted from district maternal health registers/logbooks. The following complications were tracked annually: cephalo-pelvic disproportion (CPD), eclampsia, antepartum haemorrhage (APH), postpartum haemorrhage (PPH), pregnancy-induced hypertension (PIH), and ruptured uterus/previa requiring caesarean section.

Data analysis

Data were entered into Microsoft Excel and analyzed using Python (version 3.11). Descriptive statistics, including mean, median, range, and standard deviation, were generated. Maternal mortality ratios were computed per 100,000 live births. Annual frequencies and percentage distributions of maternal complications were summarized in tables and graphs. Trends across the three-year period were also presented graphically to illustrate changes over time.

Ethical considerations

Permissions were obtained from the Atiwa East District Health Directorate prior to data collection. The data used were aggregate and de-identified; no individual patient identifiers were accessed. Since this was a secondary data review and no human subjects were directly involved, formal ethical clearance was not required. Approval followed local institutional protocols for secondary data use.

Results

Total deliveries and maternal outcomes

Table 1 summarizes total deliveries and maternal outcomes from 2021-2023. Out of 3,867 deliveries, 781 women received transfusions while 3,086 did not. There were 3 maternal deaths, resulting in a Maternal Mortality Rate (MMR) of 77.5 per 100,000 live births. This data highlights key indicators of maternal health over the three-year period

Table 1 Maternal Health Outcomes in Atiwa East District, 2021–2023

Parameter	Frequency (n)	% of Deliveries
Total Deliveries	3,867	100.0
Maternal Deaths	3	0.08
Women Transfused	781	20.2
Women Not Transfused	3,086	79.8
Maternal Mortality Ratio (per 100,000)	77.5	—

Blood transfusion burden and maternal mortality trends

Between 2021 and 2023, a total of 781 blood transfusions were recorded, with annual counts ranging from 145 in 2022 to 346 in 2023. On average, about 260 transfusions were administered each year. The highest transfusion burden in 2023 coincided with increased cases of postpartum hemorrhage (PPH) and pregnancy-induced hypertension (PIH), both of which are known to increase the risk of obstetric bleeding. Interestingly, 2022 recorded the lowest transfusions (145) but the highest maternal mortality (2 deaths), suggesting that limited availability or delays in transfusion may have contributed to poor outcomes (Table 2).

Table 2 Blood Transfusion and Maternal Mortality

Year	Blood Transfusions	Maternal Deaths
2021	290	0
2022	145	2
2023	346	1
Total	781	3

Descriptive statistics of maternal complications

In 2021, maternal complications averaged 11.3 cases, ranging from 1 (postpartum haemorrhage) to 20 (cephalo pelvic disproportion). In 2022, the average rose to 13.5 cases, with counts between 2 (postpartum haemorrhage) and 22 (antepartum haemorrhage). By 2023, the average reached 18.2 cases, with the lowest being 1 (ruptured uterus) and the highest 34 (pregnancy-induced hypertension) (Table 3).

Figure1 illustrates the trends in selected maternal complications recorded in Atiwa East District from 2021 to 2023. Cephalopelvic disproportion (CPD) and pregnancy-induced hypertension (PIH) showed marked increases over the three-year period, with CPD

rising from 20 cases in 2021 to 32 in 2023, and PIH doubling from 18 to 34 cases. Antepartum haemorrhage (APH) remained consistently high, with 15 cases in 2021 and 22 cases in both 2022 and 2023. Postpartum haemorrhage (PPH), though initially low, demonstrated a sharp increase from 1 case in 2021 to 10 in 2023. Eclampsia exhibited a fluctuating pattern, increasing from 12 cases in 2021 to 18 in 2022, but declining to 10 in 2023. Ruptured uterus remained relatively rare, with fewer than five cases annually. Overall, the data indicate rising burdens of hypertensive disorders and haemorrhagic complications, with implications for strengthening maternal health services in the district.

Table 3 Descriptive Statistics of Maternal Complications (Atiwa East District)

Year	Mean	Median	Min	Max	Std Dev
2021	11.33	13.5	1	20	7.70
2022	13.50	18.0	2	22	7.57
2023	18.17	16.0	1	34	11.88

Linear trend analysis of obstetric complications

Trend analysis, however, revealed clear upward patterns for some conditions. Pregnancy induced hypertension (slope = +8.0 cases/

year, $R^2 = 0.75$), postpartum haemorrhage (slope = +4.5 cases/year, $R^2 = 0.83$), and ante partum haemorrhage (slope = +3.5 cases/year, $R^2 = 0.75$) showed strong increasing trends over the three years. Cephalo pelvic disproportion also demonstrated a moderate upward trend (slope = +6.0 cases/year, $R^2 = 0.63$). These results suggest a rising burden of pregnancy-induced hypertension and haemorrhage-related complications in the Atiwa East District (Table 4).

Table 4 Linear Trend Analysis of Obstetric Complications

Condition	Slope (cases/year)	R^2	Interpretation
Cephalo pelvic disproportion (CPD)	+6.0	0.63	Moderate upward trend
Eclampsia	-1.0	0.06	No clear trend
Ante partum haemorrhage (APH)	+3.5	0.75	Strong upward trend
Postpartum haemorrhage (PPH)	+4.5	0.83	Strong upward trend
Pregnancy induced hypertension (PIH)	+8.0	0.75	Strong upward trend
Ruptured uterus previa c/s	-0.5	0.25	Slight downward/unstable trend

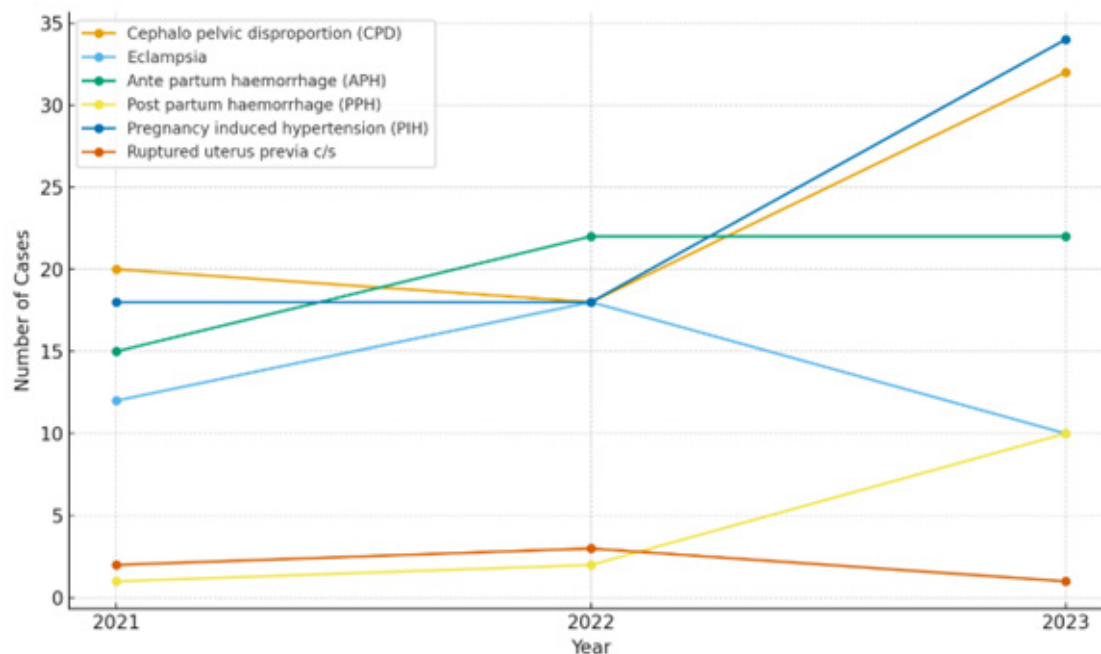


Figure1 Trend in Maternal Complications (2021-2023) in Atiwa East District.

Discussions

This retrospective analysis provides evidence of increasing maternal complications in Atiwa East District, particularly pregnancy-induced hypertension (PIH) and postpartum haemorrhage (PPH). Although the maternal mortality ratio (77.5/100,000 live births) was lower than Ghana's national average of 308/100,000,¹ the observed upward trends indicate emerging risks for both mothers and newborns.

The PIH prevalence in Atiwa East is similar to findings in Northern Ghana (7.8%)¹¹ but lower than the 8.8% reported in the Central Region.¹² The rising trend may be an indication of increasing burden of non-communicable diseases such as obesity and hypertension among women of reproductive age,¹² as well as better facility-based detection and reporting. PPH trends are consistent with studies across rural Ghana, where poor uterotonic quality, late ANC initiation, and pre-existing anaemia remain key drivers.^{13,14}

Several factors could explain the observed increases. First, demographic shifts such as older maternal age, primigravida, and prior caesarean section are established risk factors for PIH.¹² Second, late initiation of antenatal care reduces early detection and management opportunities, worsening outcomes.¹⁵ Third, persistent gaps in facility readiness, including shortages of quality uterotonics and delays in transfusion services, exacerbate the impact of PPH.¹⁴ Finally, geographic barriers and referral delays in rural districts like Atiwa East may magnify the severity of complications, a pattern observed elsewhere in Ghana.¹⁶

Both PIH and PPH are strongly linked to adverse neonatal outcomes, including preterm birth, intrauterine growth restriction, low birth weight, and perinatal mortality.¹¹ In this study, the high transfusion burden (20.2%) indirectly signals risk for neonatal hypoxia and preterm delivery, though neonatal-specific data were limited. Strengthening maternal care systems therefore has dual benefits for mothers and newborns.

Limitations

This study relied on retrospective review of facility records, which may have been affected by incomplete or inconsistent documentation. Only recorded cases were analysed, meaning complications occurring at home or in facilities outside the district may have been missed, potentially underestimating the true prevalence. The three-year period, while useful for identifying short-term trends, limits assessment of longer-term patterns. In addition, neonatal outcome data were not comprehensively captured, restricting analysis of direct maternal neonatal associations. Furthermore, individual-level demographic information such as maternal age, parity, socioeconomic status, and antenatal care attendance was not available. The absence of these variables limited the ability to stratify findings or adjust for potential confounding factors, which may have influenced the observed associations.

Conclusion

This study revealed rising trends in pregnancy-induced hypertension, postpartum haemorrhage, and cephalopelvic disproportion in Atiwa East District, while maternal mortality remained relatively low. These complications pose serious risks for neonatal survival, particularly through preterm birth and low birth weight. Strengthening antenatal surveillance, ensuring availability

of quality uterotonics and blood transfusion services, training health workers in emergency obstetric and neonatal care, and improving referral and community sensitisation systems are critical steps to reduce maternal and neonatal morbidity and mortality.

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Author contributions

Williams Ampadu Oduro designed the study and drafted the paper, Rexford Atta Kwakye and Eunice Eduful collected and cleansed the data, Williams Ampadu Oduro revised the draft paper and wrote the manuscript. All authors reviewed the manuscript.

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Data availability

The datasets generated and/or analyzed in this study are not publicly accessible but can be made available by the corresponding author upon reasonable request.

Declarations

Ethics approval and consent to participate

Permissions were obtained from the Atiwa East District Health Directorate prior to data collection. The data used were aggregate and de-identified; no individual patient identifiers were accessed. Since this was a secondary data review and no human subjects were directly involved, formal ethical clearance was not required. Approval followed local institutional protocols for secondary data use.

Consent for publication

Not applicable

Declaration of interests

The authors declare no competing interests.

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